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30. PRELIMINARY STUDIES ON SPIDER DIVERSITY AND THEIR WEBS IN SELECTED SACRED GROVES IN KERALA

Nature worship has been an ancient Indian tradition and all forms of life have been considered as sacred in Hindu scriptures. Certain landscapes or plants were also considered sacred. These sacred groves are pockets of climax vegetation preserved by religious sentiments. Such pockets are commonly referred to as "Kavu" in Malayalam, "Devarais" in Marathi, "Pavithravanam" or "Sindhra vanam" in Kannada and "Kadu" in Tamil (Induchoodan 1988). It is well known that the sacred trees such as banyan, peepal and other species of *Ficus* support a variety of life forms.

Spiders may be sedentary, social and could be cannibalistic. They are skilful hunters (Lococids), jumpers (Attids), excellent architects and specialized swimmers. All spiders are carnivorous. They are distributed extensively in the field, thick forest floors as well as in the human habitations and deserted buildings, under stones and logs and the tree trunks. Some of the spiders like *Araneus*, *Argiope*, *Leucauge* and *Gasteracantha* are orb web weavers. Members of Family Pholcidae make irregular webs, while those of Family Eresidae construct compact nests

with many entrance holes. These nests are most commonly found in India on Acacia trees and shrubs. Some of the spiders prepare no webs or snares to catch their prey. Families Lycosidae, Gnaphosidae, Clubionidae, Sparassidae, Salticidae, Oxyopidae and Thomisidae are hunting or running spiders. The role of spiders in the biogenesis of different agro-ecosystems has been studied since 1943 (Kagan 1943, Whitcomb *et al.* 1963, Whitcomb and Bell 1964, Neyffler and Benz 1979, 1980, Doane and Dondale 1979, Doane *et al.* 1982). They have an important role in controlling pests. Crab spiders are of tremendous economic relevance in tropical countries as they capture and feed on cockroaches and domestic insect pests. *Heteropoda venatoria*, the giant crab spider could be effectively used to control cockroaches and other insect pests because of its preference for these creatures as prey.

Iringole Sacred Grove: The Iringole sacred grove is situated in Perumbavoor, Ernakulam district, Kerala. It is spread around about 10 ha and lies between 10° 10' N and 76° 30' E. The grove is more or less at sea level. The

forest type is Southern Tropical West Coast Evergreen (Champion and Seth 1968). It has a luxuriant growth of trees, shrubs and herbs. The dominant tree species are *Hopea parviflora*, *Hopea ponga*, *Vateria indica*, *Holigarna arnottiana*, *Polyalthia fragrans*, *Mesua nagassarium*, *Aporusa lindleyana*, *Casearia esculenta*, *Cinnamomum malabathrum*, *Mallotus philippensis*, *Myristica malabarica*.

Mookuthala Sacred Grove: Mookuthala sacred grove (c. 3 ha) is situated in the Nannamukku Village of Malapuram district, Kerala and lies between 10° 49'-11° 40' N and 75° 50'-76° 35' E.

The Mookuthala forest sacred grove is a lowland, Southern Tropical West Coast Evergreen type (Champion and Seth 1968). The dominant tree species in this locality is *Poeciloneuron indicum* (Butham Kolli). *Aglaia elaeagnoidea*, *Caryota urens* and *Ervatamia heyneana* are also abundant.

Sangukulangara Sacred Grove: Sangukulangara sacred grove (c. 3 ha) is situated in Srinarayanapuram near Kodungallur of Thrissur district, Kerala between 10° 43' N and 76° 53' E and can be classified as Southern Tropical West Coast Evergreen (Champion and Seth 1968). The vegetation mainly consists of *Hopea ponga*, *Memecylon umbellatum*, *Artocarpus hirsutus*, *Syzygium caryophyllatum*, *Garcinia gummi-gutta*, and *Xanthophyllum flavescens*.

The study was conducted in three selected sacred groves in Kerala from December 1991 to March 1998 following quadrat method (Ludwig and Reynolds 1988). Plots of 10 m x 10 m were laid randomly in different locations in the grove. Each grove was surveyed in the morning (0730-0930 hrs), afternoon (1200-1400 hrs) and evening (1600-1800 hrs). The spiders were identified along with the type of web, number of radials, number of rings, web height from ground level and the plant species used for anchoring the web (Table 1).

The spiders collected were preserved and later identified with the help of a standard key (Pocock 1900; Subramanyam 1968a, b; Tikader 1976, 1980, 1982; Tikader and Biswas 1981; Vijayalakshmi and Ahimaz 1993) and an ordinary hand lens. Quantitative information like richness, diversity and evenness of distribution were found using SPDIVERS.BAS in STATECOL (Ludwig and Reynolds 1988).

Fourteen species of spiders were recorded (Table 2), all of which are widely distributed in India. Mookuthala sacred grove had the highest number of spider species (8) followed by Sangukulangara (7) and Iringole (6).

Iringole Sacred Groves: A total of 152 spiders were recorded during the study period in Iringole. *Argiope anasuja* (35.52%) was the commonest in the area followed by *Araneus nympa* (22.36%), *Hippasa agelenoides* (17.10%), *Gasteracantha geminata* (15.78%), *Cyrtophora moluccensis* (8.55%) and *Tegenaria* sp. (0.65%).

Mookuthala Sacred Grove: A total of 275 spiders were recorded during the study period in Mookuthala. *Argiope anasuja* (36.00%) was found to dominate in the area followed by *Araneus nympa* (20.00%), *Hippasa agelenoides* (11.27%), *Tegenaria* sp. (10.54%), *Gasteracantha geminata* (8.72%), *Crossopriza lyoni* (8.72%), *Lycosa quadrifer* (4.36%) and *Poecilotheria rufilata* (0.36%).

Sangukulangara Sacred Grove: Out of the 472 spiders recorded in Sangukulangara, the highest percentage recorded was of *Stegodyphus sarasinorum* (44.06%) followed by *Argiope anasuja* (21.9%), *Hersilia savignyi* (13.13%),

TABLE I
DETAILS OF SAMPLING EFFORT

Name of grove	No. of days spent	No. of plots	Total No. of spiders
Iringole	9	270	152
Mookuthala	8	240	275
Sangukulangara	8	240	472

TABLE 2
SPIDER SPECIES RECORDED
IN THE THREE SACRED GROVES

Family and Species name	SG1	SG2	SG3
I. Araneidae			
<i>Argiope anasuja</i> Thorell	54	99	102
<i>Gasteracantha geminata</i> (Fabricius)	24	24	47
<i>Nephila maculata</i> (Fabricius)	-	-	24
<i>Cyrtophora moluccensis</i> (Doleschal)	13	-	-
<i>Araneus nympha</i> Simon	34	55	-
II. Hersilidae			
<i>Hersilia savignyi</i> Lucas	-	-	62
III. Oxyopidae			
<i>Oxyopes rufisternis</i> Pocock	-	-	11
IV. Lycosidae			
<i>Lycosa quadrifer</i> Gravely	-	12	-
<i>Hippasa agelenoides</i> (Simon)	26	31	-
V. Pholcidae			
<i>Crossopriza lyoni</i> Blackwall	-	24	-
VI. Psechridae			
<i>Fecenia travancoria</i> Pocock	-	-	18
VII. Eresidae			
<i>Stegodyphus sarasinorum</i> Karsch	-	-	208
VIII. Theraphosidae			
<i>Poecilotheria rufilata</i> Pocock	-	1	-
IX. Agelenidae			
<i>Tegenaria</i> sp.	1	29	-
Total	152	275	472

SG1 = Iringole, SG2 = Mookuthala, SG3 Sangukulangara, - = absent

TABLE 3
RICHNESS INDICES OF SPIDERS IN THREE
DIFFERENT SACRED GROVES

Indices	SG1	SG2	SG3
N ₀	6.00	8.00	7.00
R1	0.99	1.24	1.97
R2	0.49	0.48	0.32

SG1 = Iringole, SG2 = Mookuthala, SG3 Sangukulangara, N₀ = No. of species, R1 = Margalef index, R2 = Menhinck index

Gasteracantha geminata (9.9%), *Nephila maculata* (5.08%), *Fecenia travancoria* (3.81%), and *Oxyopes rufisternis* (2.33%).

Richness Indices: The richness indices of the spider community in three different sacred groves are presented Table 3. The R1 value is high in Sangukulangara sacred grove (R1 = 1.97) followed by the Mookuthala sacred grove (R1 =

1.24), indicating the richness of the area.

Evenness Indices: To quantify the evenness component of the diversity, five indices were used. E1, E2 and E3 are considered here for interpretation because these values are sensitive to the number of species in the sample. The evenness was observed to be more in Iringole and less in Mookuthala sacred grove (Table 4). The E4 and E5 values are unaffected by the richness (Ludwig and Reynolds 1988).

TABLE 4
EVENNESS INDICES OF SPIDERS
IN THREE DIFFERENT SACRED GROVES

Indices	SG1	SG2	SG3
E1	0.85	0.84	0.79
E2	0.77	0.72	0.67
E3	0.73	0.68	0.62
E4	0.92	0.83	0.78
E5	0.90	0.79	0.72

SG1 = Iringole, SG2 = Mookuthala, SG3 = Sangukulangara, E1-E5 = Evenness indices proposed by various authors (Ludwig and Reynolds 1988)

Diversity Indices: Simpson's index (I) are highest in Sangukulangara, followed by Iringole and Mookuthala. Shannon Wiener index H' is the most widely used index in community ecology. The H' value increases when all the species are represented by same numbers of individuals or in other way with even distribution of abundance's. N1 value is high for Mookuthala (5.78) and shows an even distribution of abundance when compared with Iringole and Sangukulangara (Table 5).

TABLE 5
DIVERSITY INDICES OF SPIDERS
IN THREE DIFFERENT SACRED GROVES

Indices	SG1	SG2	SG3
λ	0.23	0.20	0.27
H'	1.53	1.75	1.55
N1	4.66	5.78	4.72
N2	4.29	4.81	3.68

SG1 = Iringole, SG2 = Mookuthala, SG3 Sangukulangara, N1 and N2 = Hill's diversity numbers

Abundance: All the spider species studied show uniform abundance in all the sacred groves (Table 6). *Stegodyphus sarasinorum*, found in social webs, was found only in the Sangukulangara sacred grove, hence the high abundance factor.

The present study on spiders indicates highest number of species in Mookuthala followed by Sangukulangara. Iringole, the largest of the sacred groves studied had only six species. The study does not indicate much variation in the number of species observed. However, it does indicate a uniform abundance in all the groves. The diversity indices do not show much difference between sacred groves.

Among the recorded species, *Argiope anasuja* and *Gasteracantha geminata* were common in all the areas. Five species namely *Nephila maculata*, *Oxyopes rufisternis*, *Hersilia savignyi*, *Fecenia travancoria* and *Stegodyphus sarasinorum* were confined only to Sangukulangara sacred grove. Three species namely *Lycosa quadrifer*, *Poecilotheria rufilata*, *Crossopriza lyoni* were recorded only from Mookuthala sacred grove and *Cyrtophora moluccensis* was observed only in Iringole.

Occurrence of various species in sacred groves seems to be correlated with the vegetation type and biotic interference. *Nephila maculata*, the spider with large sized web was recorded only from the least disturbed, but thick grove in Sangukulangara. *Lycosa quadrifer* and *Poecilotheria rufilata* are ground dwelling spiders. *Hippasa agelenoides* and *Tegenaria* sp. are seen mostly on grasses. These four species were found mostly in Mookuthala followed by Iringole, the groves having grassy ground floor. The tree dwellers are mostly seen in Sangukulangara and Mookuthala where most trees are undisturbed. Further, the presence of bonnet macaque, which move around a lot in Iringole could have also been one of the reasons for the absence of large web making species such as *Nephila maculata*.

TABLE 6
ABUNDANCE OF SPIDER SPECIES
IN THREE SACRED GROVES

Sl. No.	Species name	Abundance (m ²)		
		SG1	SG2	SG3
1	<i>Argiope anasuja</i>	.01	.01	.01
2	<i>Gasteracantha geminata</i>	.01	.01	.01
3	<i>Nephila maculata</i>	-	-	.01
4	<i>Cyrtophora moluccensis</i>	.01	-	-
5	<i>Araneus nympha</i>	.01	.01	-
6	<i>Hersilia savignyi</i>	-	-	.01
7	<i>Oxyopes rufisternis</i>	-	-	.01
8	<i>Lycosa quadrifer</i>	-	.01	-
9	<i>Hippasa agelenoides</i>	.01	.01	-
10	<i>Crossopriza lyoni</i>	-	.01	-
11	<i>Fecenia travancoria</i>	-	-	.01
12	<i>Stegodyphus sarasinorum</i>	-	-	12
13	<i>Poecilotheria rufilata</i>	-	.01	-
14	<i>Tegenaria</i>	.01	.01	-

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31. NOTES ON *CLEMATIS BOURDILLONII* DUNN (FAMILY RANUNCULACEAE)

(With one plate)

Clematis bourdillonii was described in 1914 by S.T. Dunn, on the basis of two collections 554 & 860 of T.F. Bourdillon from Merchiston Estate, Travancore (presently in Kerala). He chose the name as a tribute to the memory of T.F. Bourdillon, who botanised Travancore during 1872-1908. The species is distinguished by its larger flowers and prolonged anther connective from *C. gouriana* Roxb. and by the entire leaf margin, without undulations, and glabrous plants (except flowers) from *C. hedyarifolia* DC. This species is endemic to the southern Western Ghats, and is known only by the type collections from Merchiston Estate.

In FLORA OF THIRUVANANTHAPURAM, Mohanan and Henry (1994) state that "This rare species could

not be collected and is not represented in MH". They examined both the specimens (syntypes) present at University College herbarium, Thiruvananthapuram, and Bourdillon 860 was designated as the lectotype. Recently, I located one of the type specimens of *C. bourdillonii* Dunn, 554 of T.F. Bourdillon and a photo of Bourdillon 860 in the Madras Herbarium, Coimbatore.

The publication on the rediscovery of *Clematis bourdillonii* Dunn from Kodaikanal Hills by Ramachandran (1998) prompted me to examine the collection from Mathikettan shola, 9.xii.1994, V.S. Ramachandran 10283 Madras Herbarium (MH). The specimens from Mathikettan shola (Ramachandran 10283, MH), characterised by ternate leaves with long,